

LISTING OF CLAIMS:

The present listing of claims replaces all prior listings or versions of claims in the present application.

1. (Currently Amended) A method for water hammerless opening of a fluid passage, comprising the steps of: characterized by that, with the method by which the
 - (a) providing a fluid passage is made open openable by operation means of an actuator operating type valve provided on the fluid passage of a pipe passage, wherein the fluid passage has a having the nearly constant pressure inside the pipe passage;
 - (b) moving a first the valve body of the actuator operating type valve is moved toward the direction of the valve opening by increasing or decreasing the afore mentioned driving input to an the actuator of the actuator operating type valve, wherein the driving input is being increased or reduced to at the first prescribed set value; and
 - (c) holding the driving input to the actuator is held at the first afore mentioned set value for a first short period of time; and then, said
 - (d) further increasing or decreasing the driving input is further increased or reduced to move make the valve body to in a state of full valve opening so, thus the fluid passage is being opened without causing a water hammer.

2. (Currently Amended) A method for water hammerless opening of a fluid passage as claimed in Claim 1, wherein the valve is it is so made that a normally closed and pneumatic pressure operating type diaphragm valve, or a normally closed and pneumatic operating type diaphragm valve, wherein each of these diaphragm valves which is of at the fixed capacity type wherein an with the inner capacity of the valve is not being changed when the valve is operated, is employed for a valve.

3. (Currently Amended) A method for water hammerless opening of a fluid passage as claimed in Claim 1, wherein it is so made that the first period of time for the driving input to the actuator being held at the set value for a short period of time is made to be less than 1 second, and at the pressure rise value of the fluid passage is made to be within 10% of at the first pressure value before the valve is made to open.

4. (Currently Amended) A device for water hammerless opening of a fluid passage, comprising: characterized by that it is so constituted that it comprised

- (a) a valve comprising a valve body;
- (b) an actuator disposed to drive the valve body;
- (c) a vibration sensor removably fixed to at the pipe passage on an the upstream side of the valve;
- (d) an electro-pneumatic conversion control device disposed to receive a to which the valve opening/closing command signal input is inputted, wherein the electro-pneumatic conversion control device comprises a data storage part, wherein an and with which the actuator operating pressure Pa inputted to the actuator is controlled by at the control signal Sc stored in advance in the data storage part; in advance, and
- (e) a computation control device comprising equipped with a comparison computation circuit, wherein the comparison computation circuit is disposed to receive as input a which the vibration detecting signal Pr from the afore-mentioned vibration sensor, at the step pressure setting signal Ps to be supplied to the actuator, at the step pressure holding time setting signal Ts, and at the permissible upper limit vibration pressure setting signal Prm are inputted, and wherein the comparison computation circuit compares the with which the afore-mentioned vibration detecting signal Pr and the permissible upper limit vibration pressure setting signal

Prm are compared, and the afore-mentioned step pressure setting signal is adjusted by the comparison computation circuit so that, thus outputting the control signal Sc is outputted by the comparison computation circuit consisting of the afore-mentioned holding time setting signal Ts and adjusted step pressure setting signal Ps to the data storage part of the afore-mentioned electro-pneumatic conversion control device, wherein the control signal Sc comprises the holding time setting signal Ts and the adjusted step pressure setting signal Ps.

5. (Currently Amended) A device for water hammerless opening of a fluid passage as claimed in Claim 4, wherein the it is so constituted that a computation control device further comprises a step pressure setting circuit, a holding time setting circuit, a permissible upper limit vibration pressure setting circuit, a vibration pressure detecting circuit and the a comparison computation circuit; and when the vibration detecting signal Pr exceeds the permissible upper limit vibration pressure setting signal Prm immediately after an the actuator operating signal is step-changed, the step pressure setting signal Ps is adjusted toward at the rising direction, and when the vibration detecting signal Pr exceeds the permissible upper limit vibration pressure setting signal Prm immediately after the actuator operating pressure Pa is made to zero from the intermediate step operating pressure, the step pressure setting signal Ps is adjusted toward at the lowering direction.

6. (Currently Amended) A device for water hammerless opening of a fluid passage as claimed in Claim 4, wherein the it is so constituted that an electro-pneumatic conversion device comprises the a data storage part that which stores the control signal Sc from the computation control device, a signal conversion part, and an electro-pneumatic conversion part, wherein an the actuator operating pressure control signal Se is outputted from the signal conversion part to the electro-pneumatic conversion part based on at the control signal Sc'

stored in advance in the data storage part so that the pipe passage is opened without causing a
in advance with which no water hammer is caused.

7. (Currently Amended) A device for water hammerless opening of a fluid passage,

comprising: wherein it is so constituted that it comprises

(a) an actuator operating type valve installed on at the fluid passage;

(b) an electro-pneumatic conversion device disposed to supply at the 2-step actuator
operating pressure P_a to the actuator operating type valve;

(c) a vibration sensor removably fixed to the pipe passage on an the upstream side of
the afore-mentioned actuator operating type valve; and

(d) a tuning box disposed to receive as input at which the vibration detecting signal
 P_r detected through the vibration sensor is inputted and to output to the electro-pneumatic
conversion device from which the control signal S_c to control at the step operating pressure
 P_s' of the afore-mentioned 2-step actuator operating pressure P_a is outputted to the electro-
pneumatic conversion device, wherein the tuning box adjusts the control signal S_c so that the
output from the electro-pneumatic conversion device of the 2-step actuator operating pressure
 P_a comprising of the step operating pressure P_s' , which makes the vibration detecting signal
 P_r nearly zero, from the electro-pneumatic conversion device by adjusting said control signal
 S_c .

8. (Currently Amended) A method for water hammerless opening of a fluid passage,

comprising the steps of: characterized by that, with the method for

(a) opening a fluid passage having for which a vibration sensor is removably fixed on
an the upstream side of an the actuator operating type valve installed on the fluid passage; and

(b) inputting at the vibration detecting signal P_r from the vibration sensor is inputted to at the tuning box; and then,

(c) inputting at the control signal S_c from the tuning box to an is inputted to the electro-pneumatic conversion device; and thus the

(d) generating a 2-step actuator operating pressure P_a generated in the electro-pneumatic conversion device when theby the afore-mentioned control signal S_c is inputted, and supplying the 2-step actuator operating pressure P_a to an being supplied to the actuator operably connected to the actuator operating type valve so that the actuator operating type valve is made to open in at the 2-step operation, wherein the 2-step actuator operating pressure P_a to be supplied to the actuator and the vibration detecting signal are compared for at the relative relationship of the two, and whenif vibration is generated at at the time when at the first step actuator operating pressure P_a rises, at the step operating pressure P_s' is lowered, and whenif vibration is generated at at the time when at the second step actuator operating pressure P_a rises, the step operating pressure P_s' is raised, and the step operating pressure P_s' of the step operating pressure P_a , to make the said vibration detecting signal P_r nearly zero, is determined by repeating a plurality of adjustments of raising or lowering the afore-mentioned step operating pressure P_s' so that the afore-mentioned actuator operating type valve is made to open based on control signal S_c data on the control signal S_e when the 2-step operating pressure P_a of the step operating pressure P_s' , to make generation of vibration nearly zero, is outputted from the electro-pneumatic conversion device.

9. (Currently Amended) A method for water hammerless opening of a fluid passage, comprising the steps of: characterized by that, with the method for

(a) opening a fluid passage having for which a vibration sensor is removably fixed on an the upstream side of an the actuator operating type valve installed on the fluid passage; and

(b) inputting a vibration detecting signal P_r to an is inputted to the tuning box; and then,

(c) inputting a control signal S_c from the tuning box to an is inputted to the electro-pneumatic conversion device; and, thus the

(d) generating a 2-step actuator operating pressure P_a generated in the electro-pneumatic conversion device by the when the aforesaid control signal S_c is inputted, and supplying the 2-step actuator operating pressure P_a to an being supplied to the actuator operably connected to the actuator operating type valve so that the actuator operating type valve is made to open in at the 2-step operation, wherein the 2-step actuator operating pressure P_a to be supplied to the actuator and the vibration detecting signal P_r are compared for at the relative relationship of the two, and when if vibration is generated at at the time when at the first step actuator operating pressure P_a drops, at the step operating pressure P_s' is raised, and when if vibration is generated at at the time when at the second step actuator operating pressure P_a drops, the step operating pressure P_s' is lowered, and the step operating pressure P_s' of the 2-step operating pressure P_a to make the said vibration detecting signal P_r nearly zero, is determined by repeating a plurality of adjustments of raising or lowering the aforesaid step operating pressure P_s' so that the aforesaid actuator operating type valve is made to open based on control signal S_c data on the control signal S_c when the 2-step operating pressure P_a of the step operating pressure P_s' , to make generation of said vibration nearly zero, is outputted from the electro-pneumatic conversion device.

10. (Currently Amended) A method for water hammerless opening of a fluid passage as claimed in Claim 8, or Claim 9 wherein it is so made that the vibration sensor and the tuning box are removable, and are can be removed after the control signal S_c data on the control signal S_c at at the time of outputting the 2-step operating pressure P_a , with which generation of

vibration is nearly zero, are inputted to atthe memory storage of the electro-pneumatic conversion device.

11. (Currently Amended) A method for water hammerless opening of a fluid passage as claimed in Claim 8, or Claim 9 wherein it is so made that the vibration sensor is provided at atthe position on the upstream side within 1000mm from the place where the actuator operating type valve is installed on the fluid passage.

12. (Currently Amended) A method for water hammerless opening of a fluid passage as claimed in Claim 8, or Claim 9 wherein it is so made that the step operating pressure holding time t of the 2-step operating pressure Pa is set at less than 1 second.

13. (Currently Amended) A method for supplying a chemical solution, comprising the steps of: wherein it is so made that with which

(a) supplying a fluid to is supplied to the fluid passage on atthe downstream side of an actuator operating type valve installed on the fluid passage by opening the fluid passage using by means of the actuator operating type valve, wherein installed on the fluid passage has having a nearly constant internal pressure therein, and the fluid is a chemical solution; wherein opening of the fluid passage includes the steps of is used for a fluid, and

i. firstly, moving atthe valve body of the actuator operating type valve is moved toward atthe direction of valve opening by increasing or decreasing atthe afore-mentioned driving input to an the actuator to the prescribed set value, wherein the actuator is operably connected to the actuator operating type valve; and

ii. secondly, holding the actuator driving input is held at the afore-mentioned set value for a first short period of time; and then, said

thirdly, further increasing or decreasing the driving input is further increased or decreased to move the valve body of the valve to make a valve in a state of full opening so that a water hammer does not occur at the time of the valve is being opened.

14. (NEW) A method for supplying a chemical solution as claim in Claim 13, wherein the first period of time is less than 1 second.

15. (NEW) A method for water hammerless opening of a fluid passage as claimed in Claim 9, wherein the vibration sensor and the tuning box are removable, and are removed after the control signal Sc data at a time of outputting the 2-step operating pressure Pa, with which generation of vibration is nearly zero, are inputted to a memory storage of the electro-pneumatic conversion device.

16. (NEW) A method for water hammerless opening of a fluid passage as claimed in Claim 9, wherein the vibration sensor is provided at a position on the upstream side within 1000mm from where the actuator operating type valve is installed on the fluid passage.

17. (NEW) A method for water hammerless opening of a fluid passage as claimed in Claim 9, wherein a step operating pressure holding time t of the 2-step operating pressure Pa is set at less than 1 second.